WORKING PAPER • DOCUMENT DE TRAVAIL

Canadian Transport Commission
Research Branch

Commission canadienne des transports
Direction de la recherche

Operating Costs for a Typical Container Ship on Alternative North Atlantic Routes

WP 20-86-21

Canada

OPERATING COSTS FOR A TYPICAL CONTAINER SHIP ON ALTERNATIVE NORTH ATLANTIC ROUTES

by

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Research Branch
Transport Industries Analysis
WP 20-86-21
December 1986

First Printing, December 1986

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FOREWORD

This paper presents a comparison of the cost of operating a typical containership on various alternative routes across the North Atlantic. It is based on the manipulation, on a micro computer, of basic cost information derived from a study by a marine consultant.

The present paper provides some insight into the factors which determine the competitiveness of Canadian and U.S. East Coast ports. The "model" used is versatile; it can be expanded to cover additional routes, to examine operating costs associated with different sizes and types of vessels, to assess the impact on costs of changing the cycle pattern and of using Canadian crews.

Whenever possible, the Commission makes publicly available the results of its research and the present report is offered in line with this policy. The opinions expressed are those of the author and do not necessarily reflect the views of the Canadian Transport Commission.

R.W. Lake
Executive Director
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December, 1986

Canada

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1. INTRODUCTION

During the past few years, the Research Branch of the CTC has devoted a considerable amount of effort to the examination of various alternative routings used to transport Canada's waterborne overseas trade. The Branch has placed particular emphasis on the so-called cargo diversion issue* and has published a total of five studies on this topic in either working paper or research report format since 1984**.

The objective of these studies has been to document the magnitude and the basic nature of the diversion phenomenon. Consequently, they have attempted to quantify the total value of Canadian overseas trade routed via U.S. gateways as well as American trade routed through Canadian ports both in terms of imports and exports. In addition, these studies have also attempted to determine the characteristics of this diverted traffic in terms of the types of commodities involved and the overseas destinations and origins of this traffic.

One of the many economic factors involved in cargo diversion obviously consists of the ocean transport and port costs associated with different possible routings

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*For convenience, the informal term "diversion" is used here despite its ambiguity, implied negative connotation and its inadequacy as a descriptive word for what is a complex phenomenon. For a thorough description of the concept see, "Canadian and American Overseas Oceanborne Trade Through Each Other's Ports", Canadian Transport Commission, Research Branch, Report No. 1985/04E, November, 1985.

**These studies are: i) "Acheminement en territoire américain du commerce outre-mer canadien à l'exportation", DT 20-84-19; ii) "Canadian and American Overseas Oceanborne Trade Through Each Other's Ports", Report No. 1985/04E; iii) "Canadian Overseas Exports of General Cargo and Port Activity in Eastern Canada", Report No. 1985/05E; iv) "Recueil statistique sur le commerce outre-mer canadien manutentionné à des ports américains - Données de 1982", DT 20-85-03 and v) "Canadian and American Overseas Trade Diversion - Perspective and Summary", WP 20-85-17.

which can be used between specific origins and destinations*. To obtain realistic quantitative data related to ocean and port costs for selected North Atlantic routes, the Research Branch engaged the services of a marine consultant, Philippe I. Georges & Associates of Montréal, to identify and quantify costs associated with the movement of container vessels across the North Atlantic**. The detailed cost figures provided by the consultant in his report were subsequently put on a micro computer. This document is based on information contained in the two-phase report submitted to the Branch by the consultant and on the manipulation of data provided by the consultant.

1.1 Objective

The purpose of this report is to compare the operating costs for a typical cellular container vessel on selected alternative routes between North America and Western Europe. More specifically, its primary objective is to determine the operating costs associated with these alternative ocean transport routings and to identify the most import factors which are responsible for major cost differences between these routings.

1.2 Scope

In view of the specific objective of this report, the data presented in it focus solely on operating costs. Capital costs associated with both the vessel and containers have been excluded from the discussion. Since all routes selected for examination can be

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*Another major cost component of the transport network which would have a significant impact on cargo diversion consists of the inland transportation costs to the selected gateway ports in North America and in Europe. These inland transport costs, however, are not addressed in the present report.

**The consultant's reports are available in limited quantities as working papers WP 20-86-25 and WP 20-86-26.

served with the same number of vessels, only the operating costs on the different routes are the relevant costs to be considered in attempting to determine the competitiveness between these routes. It is also worth noting that decisions by shipping lines between alternative routings are in fact largely influenced by operating costs. The report discusses operating costs in terms of four broad categories, namely daily vessel operating costs, fuel costs, port charges and container handling charges, and presents an overall comparison of the operating costs on the alternative routes on the basis of the average cost per TEU slot per round trip. Since the international shipping industry generally tends to use U.S. dollars as the working currency, all costs presented in this report are expressed in terms of U.S. dollars. All calculations for port charges and cargo handling costs at the various ports were developed in the local currency and subsequently converted into U.S. dollars using the exchange rates shown in the following table.

Table 1

Exchange Rates Used in Study

$1 U.S. = 0.695	Pound Sterling
$1 U.S. = 1.36	Canadian Dollars
$1 U.S. = 7.98	French Francs
$1 U.S. = 53.10	Belgian Francs
$1 U.S. = 2.615	German Marks

1.3 Limitations of the Study

Before embarking on a discussion of the approach used by the consultant to develop the operating costs associated with the selected alternative routings, the limitations of the study should be noted. In the first instance, the selected vessel for

which the cost comparison on the various routings is carried out represents the maximum size of ship that can operate into the port of Montreal. The ports on the Atlantic seaboard, however, can accommodate considerably larger container ships. These larger vessels would, in all probability, have significantly lower average costs per TEU slot. Secondly, it should be again stressed that the cost comparisons presented in this report reflect only port costs in North America and in Europe and ocean transport costs. Inland transport costs to and from ports are not taken into consideration. If these inland costs were also taken into account, the cost relationships between the selected routings for a total door-to-door movement to a specific inland destination could be significantly altered. Thirdly, it should be noted that the cost figures presented in this report represent only the cost per TEU slot to the operator of the vessel. The analysis does not take into consideration the ease or difficulty of obtaining cargo at various ports.

2. DESIGNATED VESSEL AND SELECTED ROUTES

2.1 Designated Vessel

The consultant's contract specified that the vessel to be selected for the development of detailed costs was to be similar to vessels which were actually operating across the North Atlantic from the port of Montreal in 1984. The vessel chosen by the consultant for analysis was a second generation cellular container ship, almost identical to the type of ships used by the St. Lawrence Co-ordinated Service at the time the study was carried out. The designated vessel has a GRT of 31 000 tons with a total container-carrying capacity of 1 800 TEU's. This ship also represents the maximum size of vessel that can operate into the port of Montreal.

The designated vessel is capable of operating at a maximum continuous speed of 22 knots, but the average steaming speed at sea on which cost calculations are based is the speed that is required to maintain a 28-day cycle for a round trip on each of the selected routes. (The 28-day cycle was selected as a criterion because it will permit a fleet of four vessels to maintain a scheduled frequency of weekly sailings on a specific day of the week.) The requirement to maintain such a 28-day cycle means that the average steaming speed on the six routes examined in this study ranges from a low of 14.7 knots to a high of 19 knots.

Since there are no Canadian flag container vessels presently operating on the North Atlantic, the hypothetical vessel is assumed to operate under the British flag for purposes of determining manning levels and calculating crew costs. The consultant was advised by the General Council of British Shipping that a conventional 1 800 TEU container vessel called for a manning level of 28 men in order to conform to all

requirements for safe operation. This crew complement of 28 men was in fact used by the consultant in the development of crew costs. The wage rates used to calculate crew costs are based on information obtained by the consultant in discussions with a ship owning and management company in the United Kingdom. These are significantly higher than the average wage scale as indicated by the General Council of British Shipping but represent a more realistic actual picture according to industry sources contacted by the consultant.

In calculating the daily vessel operating costs, it is assumed that the ship will operate 358 days a year, with a refit of about two weeks' duration every two years. During this vessel refit, the regular weekly schedule of sailings can be maintained by having the remaining three vessels make up the time with faster turnarounds. The selected vessels have sufficient extra speed as well as a time leeway in the 28-day cycle to enable them to make up the required time. In this regard it should be noted that all voyage cycles already include an allowance for both delays at sea and delays in ports. The first of these consists of an allowance of 5% above the actual calculated steaming time for each route while the second amounts to a 10% allowance above the calculated time required for loading and unloading the vessels at each port.

2.2 Selected Routes

A total of six routes were selected for which operating costs were developed. Three of these routes involve calls at a single Canadian port on the North American end — these being Montreal, Halifax and Saint John*. Two routes involve calls at a

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*It should be stressed that in view of the large size of the designated vessel together with a weekly service frequency, it is quite unlikely that such a vessel will obtain sufficient cargo from a call at Halifax or Saint John. It was felt, however, that it would still be useful to calculate the operating costs for routes from these ports.

single U.S. port, namely New York and Baltimore, both of which compete with Montreal in servicing both Canadian and American shippers. The sixth and final route selected for cost comparison consists of the so-called triangular service where a vessel calls at three ports in North America, namely Halifax, New York and Baltimore. This triangular service involves two calls at the port of Halifax. The first is to discharge imported containers bound for Canadian and New England/U.S. Midwest markets while the second call is to load Canadian cargo for European destinations. Such a triangular service is in fact operated by ACL on the North Atlantic.

With regard to the European end, most container lines call at a minimum of three or four ports with two calls being made at the European port with the greatest traffic volume — one call to discharge and the second call to load. All the routes examined in this report involve calls at the following four European ports — Felixstowe, Hamburg, Antwerp and LeHavre. The itinerary at the European end consists of a first call at Felixstowe to discharge cargo, followed by calls at Hamburg and Antwerp to both discharge and load, a second call at Felixstowe to load only and a final call at LeHavre to discharge and load before sailing to Montreal.

3. ROUND TRIP OPERATING COSTS

Before proceeding to a comparison of costs on the alternative routes examined in this report it is useful to provide a discussion of the individual components which are included in each of the four major cost categories and to identify the main factors which are responsible for the cost differences on the six routes. Since the itineraries at the European end for all of these routes are identical, and thus remain a constant, the discussion on port charges and container handling charges will be confined to the five ports at the North American end of these routes.

3.1 Daily Vessel Operating Costs

The daily vessel operating costs become, in effect, fixed costs once a decision is made to put a vessel into service and are calculated by dividing the total annual costs in this category by the number of days (358 in the present report) that the vessel operates in a year. The major sub-components in this cost category are: i) crew costs, including overtime, vacation leave, sick leave, pensions, social security, redundancies, etc.; ii) stores and supplies which covers catering stores and all other supplies required by the ship; iii) insurance; iv) maintenance and repairs; and v) general administration.

Since the vessel operates on a 28-day cycle on all routes, the daily vessel operating costs for a round trip does not vary on five of the six routes. With respect to the route from Montreal, the slightly higher vessel operating costs are due to a higher insurance premium for this route.

Crew costs accounted, by a wide margin, for the largest proportion of daily vessel operating costs amounting to almost 45% of this cost category. The proportion of other cost items in this category ranged from a high of 17% for stores and supplies to a low of some 6% for the general administration component.

3.2 Fuel Costs

This category includes both fuel for the main engines when the ship is sailing, Intermediate Fuel Redwood 1500, and the fuel required to operate the auxilliary equipment on the vessel, Marine Diesel Oil (OMD). Since the round trip voyage on all routes takes 28 days, the cost related to OMD to operate auxilliary equipment is identical for all routes. The major factors accounting for the variation in the consumption and cost related to Intermediate Fuel Redwood 1500 are the difference in the distances involved in the alternative routes across the North Atlantic and the difference in the average speed which is required to maintain the 28-day cycle on all routes.

3.3 Port Costs

The major elements in this cost category consist of: i) pilotage costs; ii) dockage and berthing dues and iii) charges for tugs. The importance of these cost components on the North American end varies significantly from port to port. For example, in the case of Montreal, pilotage charges accounted for about 38% of total port expenses* while in all the other four North American ports these charges were less than

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*This percentage rises to 51% of total port costs in the winter months when regulations require the use of two pilots.

20% of total port related expenses. This, of course, is due to the fact that vessels calling at Montreal are required to use a pilot for the trip up and down the St. Lawrence River while at other North American ports, a pilot is taken on only a relatively short distance from the port in question. On the other hand, dockage dues accounted for almost 36% of port expenses in New York and close to 52% of these expenses in Baltimore. In contrast, dockage dues made up some 19% of port expenses in Montreal and 29% and 26% respectively at the ports of Halifax and Saint John.

With regard to the proportion of tug charges in total port costs, these expenses ranged from a low of 11% in the case of Montreal to a high of 24% for the port of Saint John.

3.4 Container Handling Charges

By far the largest single component in container handling charges is the container box rate. This is a fixed negotiated rate which remains the same whether the box is a 20-foot, half-height or 40-foot container and applies equally to both full and empty containers*. The container box rate generally covers the handling of containers during straight-time hours on weekdays, that is Monday to Friday between the hours 8:00 - 12:00 and 13:00 - 17:00**. Any work outside these hours is subject to an overtime differential, either time and a half or double time, depending on the time of day. The

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*Since the same container box rate applies to both 40-foot and 20-foot containers, the average cost per TEU handled can be significantly affected by a variation in the mix of 40-foot and 20-foot boxes.

**It should also be noted that the container box rate generally covers the cost of only two movements, namely from rail car or trailer to stack and from stack to ship or vice versa. If more than two lifts are required for any reason, extra charges are levied for such moves.

container box rate accounted for 62% - 66% of total cargo handling charges in all the North American ports examined except New York. In the latter, the container box rate amounted to some 49% of total container handling charges.

The second major component of container handling charges consists of the assessments which are levied on all cargo moving through ports. These are paid to the Maritime Employers Association at Canadian ports and to the International Longshoremen's Association in U.S. ports to cover job security and administrative costs associated with shore labour. These assessments ranged from a high of 39% of total container handling charges at the port of New York* to a low of 10% at the three Canadian ports examined in the report. The third largest component in this cost category consists of wharfage charges imposed by ports for the use of berthing space and ranged from a low of 6% to a high of 15%.

Other charges which make up a much less significant proportion of overall cargo handling costs consist of overtime payments for shore labour, extra labour charges for tasks not covered by the container box rate, charges for lost time when gangs are not able to work due to delays which are not caused by the contractor and charges for securing or lashing of all containers which are carried on the vessel's deck.

3.5 Comparison of Costs on Alternative Routes

Tables 2 to 8 present a comparison of the costs of operating a 31,000 GRT cellular container vessel with a capacity of 1800 TEU's on various alternative routes

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*In absolute dollar terms, these assessments at New York are more than 2 1/2 times the level of such assessments at the port of Baltimore.

across the North Atlantic in 1985. Table 2 is a summary table which presents a comparison of the major cost categories for all the six selected routes while Tables 3 to 8 provide some more detailed information on each of these routes.

As is shown in Table 2, the cost per TEU slot for the six routes ranges from a low of $295 U.S. for the route involving a single call at Halifax on the North American end to a high of $476 U.S. for the route terminating at New York. If the cost per TEU slot for the Montreal route is taken as the base, then costs per TEU for the Halifax and Saint John routes are some 12% and 10% lower respectively than the cost for the Montreal route. With regard to the other three routes — New York, Baltimore and the triangular service — costs are approximately 42%, 18% and 25% higher than the cost per TEU slot for the Montreal route.

3.6 Observations

1. By far the most important factor which is responsible for the major differences in operating costs per TEU slot on the various routes is the wide variation in container handling charges at the different ports in North America. The importance of container handling charges in the competitiveness between various routes is indicated by the fact that if these costs in the port of New York were reduced to the same level as those in Baltimore, the difference in the cost per TEU between the New York route and the Montreal route would drop from 42% to only 15% while the cost difference between the triangular service and the Montreal route would decline from 25% to 15%.

Table 2

COMPARISON OF ROUND-TRIP OPERATING COSTS FOR ALTERNATIVE ROUTES ON THE NORTH ATLANTIC IN 1985

(U.S. Dollars)

	Montreal	Halifax	Saint John	New York	Baltimore	Triangular Service
Vessel Operating Costs	155 016	154 283	154 283	154 283	154 283	154 283
Fuel	152 769	104 988	126 139	160 112	201 405	208 722
Port Charges	131 628	125 049	126 300	142 323	142 433	171 106
Container Handling Charges	761 694	677 408	677 331	1 258 118	924 715	967 258
Total Operating Costs	1 201 107	1 061 729	1 084 052	1 714 837	1 422 837	1 501 368
Cost per TEU Slot	334	295	301	476	395	417

Notes: 1) The European ports of call for all routes consist of Felixstowe, Hamburg, Antwerp and LeHavre.
2) For the Triangular Service, the North American ports of call are Halifax, New York and Baltimore.
3) Port charges for Montreal represent costs incurred in the summer. In the winter months these increase by $9 957 (U.S.) per call due to higher charges for pilotage and tugs.
4) Cost per TEU slot is based on the 3 600 TEU slots which are available per round trip.

Source: Tables 3 to 8.

2. The possibility of using larger vessels for calls at ports on the Atlantic seaboard as opposed to Montreal means that, due to the existence of economies of scale, the actual attainable unit costs per TEU slot for these routes are likely to be significantly lower than indicated in this report.

3. In view of the foregoing comments and the existence of a relatively small cost difference between Montreal and Baltimore (18%), any changes that would result in increased costs on the Montreal route (e.g. user charges for icebreaker service on the St. Lawrence, higher pilotage charges to shipping lines) might well have a significant impact on the competitiveness of Montreal vis-à-vis Baltimore and possibly New York.

4. While both Halifax and Saint John have a cost advantage over Montreal, these ports would find it difficult to generate sufficient cargo to fill an 1800 TEU vessel with a weekly service frequency. However, with the increasing importance of inland load centres and unit train movements of containers from such load centres, the cost advantage enjoyed by Halifax might well become a significant factor in influencing the selection of a North Atlantic ocean transport routing.

Table 3

MONTREAL TO EUROPE

	Montreal		Felixstowe	Hamburg	Antwerp	Felixstowe	LeHavre
DETAILED ITINERARY							
Time in Port (days)	3.50		1.00	0.75	1.25	0.83	0.75
Allowance for Delays in Port (days)	0.35		0.10	0.08	0.13	0.08	0.08
Distance (nautical miles)		3 230	360	376	138	200	3 122
Time at Sea (days)		7.92	0.88	0.92	0.34	0.49	7.65
Allowance for Delays at Sea (days)		0.40	0.04	0.05	0.02	0.02	0.38
Duration of Voyage (days)	28.00						
Average Speed (knots)	17.00						

DETAILED COSTS (IN U.S. $)

Daily Vessel Operating Cost

Per Day	$ 5 536
Per Voyage	$155 016

Fuel Consumption & Cost

Int. 1 500 (tonnes/voyage)	946.7
OMD (tonnes/voyage)	70.0
Int. 1 500 (cost/voyage)	$136 319
OMD (cost/voyage)	$ 16 450

Costs in Ports	Port Charges	Cargo Handling Charges
Montreal	$ 19 012	$458 606
Felixstowe	$ 24 165	$ 89 122
Hamburg	$ 21 338	$ 49 346
Antwerp	$ 25 625	$ 47 014
Felixstowe	$ 24 165	$ 75 411
LeHavre	$ 17 324	$ 42 195
Total for Voyage	$ 131 628	$761 694

TOTAL COSTS PER VOYAGE : $1 201 107 (U.S.)

Source: Research Branch, Canadian Transport Commission, based on data provided by Philippe I. Georges & Associates, Marine Consultants, Montreal.

Table 4

HALIFAX TO EUROPE

	Halifax		Felixstowe	Hamburg	Antwerp	Felixstowe	LeHavre
DETAILED ITINERARY							
Time in Port (days)	3.50		1.00	0.75	1.25	0.83	0.75
Allowance for Delays in Port (days)	0.35		0.10	0.08	0.13	0.08	0.08
Distance (nautical miles)		2 747	360	376	138	200	2 610
Time at Sea (days)		7.77	1.02	1.06	0.39	0.57	7.39
Allowance for Delays at Sea (days)		0.39	0.05	0.05	0.02	0.03	0.37
Duration of Voyage (days)	28.00						
Average Speed (knots)	14.72						
DETAILED COSTS (IN U.S. $)							
Daily Vessel Operating Cost							
Per Day	$ 5 510						
Per Voyage	$154 283						
Fuel Consumption & Cost							
Int. 1 500 (tonnes/voyage)		614.8					
OMD (tonnes/voyage)		70.0					
Int. 1 500 (cost/voyage)	$ 88 538						
OMD (cost/voyage)	$ 16 450						

	Port Charges	Cargo Handling Charges
Costs in Ports		
Halifax	$ 12 433	$374 320
Felixstowe	$ 24 165	$ 89 122
Hamburg	$ 21 338	$ 49 346
Antwerp	$ 25 625	$ 47 014
Felixstowe	$ 24 165	$ 75 411
LeHavre	$ 17 324	$ 42 195
Total for Voyage	$ 125 049	$677 408

TOTAL COSTS PER VOYAGE: $1 061 729 (U.S.)

Source: Research Branch, Canadian Transport Commission, based on data provided by Philippe I. Georges & Associates, Marine Consultants, Montreal.

Table 5

SAINT JOHN TO EUROPE

DETAILED ITINERARY	Saint John		Felixstowe	Hamburg	Antwerp	Felixstowe	LeHavre	
Time in Port (days)		3.50	1.00	0.75	1.25	0.83	0.75	
Allowance for Delays in Port (days)		0.35	0.10	0.08	0.13	0.08	0.08	
Distance (nautical miles)		3 006	360	376	138	200		2 827
Time at Sea (days)		7.92	0.95	0.99	0.36	0.53		7.45
Allowance for Delays at Sea (days)		0.40	0.05	0.05	0.02	0.03		0.37
Duration of Voyage (days)	28.00							
Average Speed (knots)	15.81							

DETAILED COSTS (IN U.S. $)

Daily Vessel Operating Cost

Per Day	$ 5 510
Per Voyage	$154 283

Fuel Consumption & Cost

Int. 1 500 (tonnes/voyage)		761.7
OMD (tonnes/voyage)		70.0
Int. 1 500 (cost/voyage)	$109 689	
OMD (cost/voyage)	$ 16 450	

Costs in Ports	Port Charges	Cargo Handling Charges
Saint John	$ 13 683	$374 243
Felixstowe	$ 24 165	$ 89 122
Hamburg	$ 21 338	$ 49 346
Antwerp	$ 25 625	$ 47 014
Felixstowe	$ 24 165	$ 75 411
LeHavre	$ 17 324	$ 42 195
Total for Voyage	$ 126 300	$677 331

TOTAL COSTS PER VOYAGE: $1 084 052 (U.S.)

Source: Research Branch, Canadian Transport Commission, based on data provided by Philippe I. Georges & Associates, Marine Consultants, Montreal.

Table 6

NEW YORK TO EUROPE

DETAILED ITINERARY	New York		Felixstowe	Hamburg	Antwerp	Felixstowe	LeHavre
Time in Port (days)	3.50		1.00	0.75	1.25	0.83	0.75
Allowance for Delays in Port (days)	0.35		0.10	0.08	0.13	0.08	0.08
Distance (nautical miles)		3 322	360	376	138	200	3 161
Time at Sea (days)		8.00	0.87	0.91	0.33	0.48	7.61
Allowance for Delays at Sea (days)		0.40	0.04	0.05	0.02	0.02	0.38
Duration of Voyage (days)	28.00						
Average Speed (knots)	17.30						

DETAILED COSTS (IN U.S. $)

Daily Vessel Operating Cost

Per Day	$ 5 510
Per Voyage	$154 283

Fuel Consumption & Cost

Int. 1 500 (tonnes/voyage)		997.7
OMD (tonnes/voyage)		70.0
Int. 1 500 (cost/voyage)	$143 662	
OMD (cost/voyage)	$ 16 450	

Costs in Ports	Port Charges	Cargo Handling Charges
New York	$ 29 707	$955 030
Felixstowe	$ 24 165	$ 89 122
Hamburg	$ 21 338	$ 49 346
Antwerp	$ 25 625	$ 47 014
Felixstowe	$ 24 165	$ 75 411
LeHavre	$ 17 324	$ 42 195
Total for Voyage	$ 142 323	$1 258 118

TOTAL COSTS PER VOYAGE: $1 714 837 (U.S.)

Source: Research Branch, Canadian Transport Commission, based on data provided by Philippe I. Georges & Associates, Marine Consultants, Montreal.

Table 7

BALTIMORE TO EUROPE

	Baltimore		Felixstowe	Hamburg	Antwerp	Felixstowe	LeHavre
DETAILED ITINERARY							
Time in Port (days)	3.50		1.00	0.75	1.25	0.83	0.75
Allowance for Delays in Port (days)	0.35		0.10	0.08	0.13	0.08	0.08
Distance (nautical miles)		3 654	360	376	138	200	3 493
Time at Sea (days)		8.09	0.80	0.83	0.31	0.44	7.73
Allowance for Delays at Sea (days)		0.40	0.04	0.04	0.02	0.02	0.39
Duration of Voyage (days)	28.00						
Average Speed (knots)	18.82						
DETAILED COSTS (IN U.S. $)							
Daily Vessel Operating Cost							
Per Day	$ 5 510						
Per Voyage	$154 283						
Fuel Consumption & Cost							
Int. 1 500 (tonnes/voyage)		1 284.4					
OMD (tonnes/voyage)		70.0					
Int. 1 500 (cost/voyage)	$184 955						
OMD (cost/voyage)	$ 16 450						

	Port Charges	Cargo Handling Charges
Costs in Ports		
Baltimore	$ 29 817	$621 627
Felixstowe	$ 24 165	$ 89 122
Hamburg	$ 21 338	$ 49 346
Antwerp	$ 25 625	$ 47 014
Felixstowe	$ 24 165	$ 75 411
LeHavre	$ 17 324	$ 42 195
Total for Voyage	$ 142 433	$924 715
TOTAL COSTS PER VOYAGE:	$1 422 837 (U.S.)	

Source: Research Branch, Canadian Transport Commission, based on data provided by Philippe I. Georges & Associates, Marine Consultants, Montreal.

Table 8
TRIANGULAR SERVICE TO EUROPE

DETAILED ITINERARY	Halifax		Felixstowe	Hamburg	Antwerp	Felixstowe	LeHavre	Halifax	New York	Baltimore
Time in Port (days)		0.63	1.00	0.75	1.25	0.83	0.75	0.63	1.25	1.00
Allowance for Delays in Port (days)		0.06	0.10	0.08	0.13	0.08	0.08	0.06	0.13	0.10
Distance (nautical miles)		2 747	360	376	138	200	2 610	593	412	892
Time at Sea (days)		6.00	0.79	0.82	0.30	0.44	5.70	1.30	0.90	1.95
Allowance for Delays at Sea (days)		0.30	0.04	0.04	0.02	0.02	0.29	0.06	0.05	0.10
Duration of Voyage (days)	28.00									
Average Speed (knots)	19.06									

DETAILED COSTS (IN U.S. $):

Daily Vessel Operating Cost		
Per Day	$ 5 510	
Per Voyage	$154 283	
Fuel Consumption & Cost		
Int. 1 500 (tonnes/voyage)		1 335.2
OMD (tonnes/voyage)		70.0
Int. 1 500 (cost/voyage)	$192 272	
OMD (cost/voyage)	$ 16 450	

Costs in Ports	Port Charges	Cargo Handling Charges
Halifax	$ 8 595	$ 69 792
Felixstowe	$ 24 165	$ 89 122
Hamburg	$ 21 338	$ 49 346
Antwerp	$ 25 625	$ 47 014
Felixstowe	$ 24 165	$ 75 411
LeHavre	$ 17 324	$ 42 195
Halifax	$ 8 595	$ 66 889
New York	$ 22 732	$343 113
Baltimore	$ 18 567	$184 376
Total for Voyage	$ 171 106	$967 258
TOTAL COSTS PER VOYAGE:	$1 501 368 (U.S.)	

Source: Research Branch, Canadian Transport Commission, based on data provided by Philippe I. Georges & Associates, Marine Consultants, Montreal.